Amendments to the Drawings:

Enclosed is one Replacement Sheet of drawings wherein Figs. 1b and 1c have been amended so as to be annotated "Prior Art." No new matter has been entered in respect of the drawing amendments.

ATTACHMENT: Replacement Sheet; 1 page

REMARKS

Applicant's counsel thanks Examiner Gabor for her very careful and thorough examination of the present application, and also for the very helpful and courteous telephone interview conducted September 12, 2005.

The Examiner has objected to the Abstract for containing "the invention relates" language. The Abstract now has been amended to overcome this rejection.

The Examiner also objected to the Drawings, on the basis that Figs. 1a-1c should be annotated as "Prior Art" because, according to the Examiner, "only that which is old is illustrated." Office action, page 2. Enclosed is a Replacement Sheet in which Figs. 1b and 1c have been so-notated. Fig. 1a has not been notated as "Prior Art" because it illustrates, schematically, a layer arrangement that is generic to the present invention, and therefore that is not "only old." The amendments to the Drawings are believed to overcome the Examiner's objection.

The specification also has been amended to correct minor errors. Basis for the specification amendments can be found, e.g., at paragraph [006] as-filed.

During the aforementioned telephone interview, the independent claims 1, 10 and 18 were discussed, with the product claim 1 being principally discussed. Specifically, the applicant proposed to amend claim 1 as presented above to specify the neutron detector of that claim comprises multiple pBN layers, and that a plurality of the pBN layers are doped with an elemental dopant "distributed across a c-plane[1] in each of said doped pBN layers."

Independent method claims 10 and 18 also have been amended along the lines discussed during the interview, to indicate the neutron detector is made having multiple doped pBN layers, wherein the dopant is provided across a c-plane in each of the doped layers. Dependent claims 2, 4, 6, 7, 11, 12, 14, 15 and 20 also have been amended to correct antecedent basis and for consistency with newly amended claims 1, 10 and 18. New claims 21-23 also have been added. No new matter has been entered; see, e.g., Fig. 1a, as well as paragraphs [009], [024] to [029], [032] and [050]. With respect to the dopant being distributed across a c-plane in the doped pBN layers, applicant's counsel agreed during the interview to explain the basis for this limitation.

Paragraph [027] of the specification describes a method for depositing doped pBN layers,

[1] This is a plane that is parallel to both the a- and b-axes; i.e. a c-plane is perpendicular to the c-axis. See Fig. 1a and paragraph [006]: "The crystallographic planes, such as the c plane, are normal to their axes, so that the c plane in pBN is predominantly parallel to the deposition layers."

in which pBN and the dopant are deposited simultaneously onto a substrate from gas-phase precursors injected into the vapor space (oven) over the substrate. Specifically, the gas-phase precursors for pBN (boron halide and ammonia) are introduced into the furnace while simultaneously introducing a hydrocarbon gas, such as methane (CH_4), "to form a co-deposit of carbon in the crystal structure of the pBN deposit, with the hydrocarbon gas concentration being carefully controlled to keep the concentration of the dopant carbon to a desired level." As would be understood by persons of ordinary skill in the art, all three of the gas-phase precursors injected into the oven will tend to disperse throughout the oven space, to minimize concentration gradients for each component. While a uniform concentration for each component may not be achieved (i.e. rate of boron halide reaction with ammonia to form BN, rate of co-deposition, convective currents resulting from injection of gas-phase precursors, etc., all may preclude uniform distribution), each component will tend to disperse in the oven, and consequently pBN as well as dopant (from dispersed hydrocarbon gas) will be deposited together across the substrate surface. The dopant may not be uniformly deposited across a c-plane such that there are no dopant concentration gradients in that plane. But the dopant nonetheless *will be distributed* across substantially an entire c-plane of the deposited pBN layer. Note that paragraph [027] explains that dopant concentration is to be "carefully controlled." Careful control of dopant in the pBN being deposited will ensure substantial distribution of dopant "across a c-plane" of the deposited doped pBN layer.

It is this embodiment of a doped pBN layer, or more accurately a plurality of them, that is now claimed; wherein the dopant will be distributed across a c-plane in each of the doped pBN layers. See also paragraphs [028]-[031] describing additional details for a deposition method that will result in the structure of such a doped pBN layer, and also Example 1.

The applied Leist and Honma references also were discussed during the telephone interview. Particularly, the foregoing claim amendments were discussed in view of these references. The Examiner agreed that she would carefully consider the amended claims, and the applicants' arguments in favor of patentability, which are summarized below.

Claims 1, 10 and 18 all have been rejected under 35 USC § 103(a) for obviousness over Leist in view of Honma. Claim 1 is addressed first.

Claim 1 has now been amended specifically to recite "a layered structure having opposed surfaces and comprising pBN *layers* [plural] between the opposed surfaces,...wherein *a plurality*

of said pBN layers are doped...for an electrical resistivity of less than about 10^{14} ohm-cm, *said elemental dopant being distributed across a c-plane in each of said doped pBN layers*." This claimed combination, where dopant is distributed across a c-plane in a plurality of pBN layers within a layered structure, is neither disclosed nor suggested by the applied references, either alone or in combination.

Specifically, Leist fails to disclose that dopant is distributed across a c-plane in the doped pBN layers. Instead, dopant is provided only in relatively narrow channels, parallel to a c-plane *but not across an entire c-plane* of the pBN layers. Furthermore, a person of ordinary skill in the art would not have been motivated to modify Leist according to Honma to co-deposit dopant and pBN to achieve dopant distribution across a c-plane of the doped pBN layers. In fact, the Leist reference ***explicitly teaches away*** from making such a combination. See Leist reference at col. 3 lns. 20-28 (emphasis supplied):

> In the past electrical contacts were applied to the two large opposing surfaces 11 of the plate 10 which lie perpendicular to the plane designated A-A in Fig. 1 [i.e. parallel to a c-plane and parallel to the deposited layers] such that electrons generated by Boron-10 and neutron interactions will pass through layers 11 [i.e. in the c-direction, along the c-axis]. *This arrangement however yielded poor results*. In accordance with the present invention electrical contacts are applied to the opposite edge surfaces 12 of the structure 10 i.e., the a-b plane surfaces of the structure which lie parallel to the thickness of the plate 10 designated B-B in Fig. 1.

In order to ensure that electrons would travel between the contacts applied to the opposite edge surfaces 12, and not through the layers along the c-axis, in Leist dopant was provided only in narrowly collimated lateral channels (parallel to c-planes) as described therein (see Fig. 4 of that reference). The narrow doped channels in Leist provided specific regions of low resistivity (high conductivity) so that a voltage could be applied across the gap between the channels. The applied voltage allows electron-hole pairs, generated by interactions between impacting thermal neutrons and ^{10}B atoms, to be separated and attracted to oppositely-charged channels (electrons to the positive polarity channel, and holes to the negative polarity channel). Upon reaching the channels, the charge-carrying particles (electrons and holes) would be detected and indicate a neutron interaction precisely between the specific set of channels, indicating the specific location of the neutron impact event. The reason for providing dopant across c-planes in the doped pBN

layers in the present application is to do precisely what was described as undesirable in the reference; i.e., to conduct electrons through the pBN layers along the c-axis direction. Hence, Leist provides a clear teaching away from the modification proposed by the Examiner, based on the Honma reference.

In addition, the proposed modification would, in fact, be highly detrimental to an important attribute of the structure in the Leist reference. To understand this, it is important first to understand the function of the detector described in the reference. By providing dopant only in narrowly collimated lateral channels (parallel to c-planes) as described therein (see Fig. 4 of that reference), thermal neutrons can be detected at specific locations when striking between a set of oppositely-charged channels. In essence, each doped channel pair can be considered one "pixel" of a thermal neutron detector that results in a positive detection signal only for thermal neutrons striking specifically in the region of a doped channel pair. (Again, see cross-section in Fig. 4 of Leist, showing end view of lateral surface of stacked pBN layer structure with a doped channel pair containing "carbon or other dopant"). By providing an array of such doped channel pairs arranged in a pBN layered structure, a corresponding array of "pixelated" thermal neutron detection points is achieved. By summing the positive detection signals for thermal neutrons striking between or in the region of channel pairs of such layered structure (or structures), a complete picture or image of the shape of the object that is emitting the neutrons can be constructed and observed.

One would not have considered modifying the detector in the Leist reference according to the teaching of Honma to provide a co-deposit of both pBN and dopant <u>across a c-plane</u> of the deposited pBN layer(s) because that would significantly impair, and probably destroy, the operability of the detector to produce pixelated detection points. Specifically, by co-depositing dopant and pBN such that dopant would be distributed across pBN layer planes, no longer confined to the narrow channels described in that reference, the pixelated character of the detector would at least be significantly impaired. Thermal neutrons would no longer be limited to positive signal detection in specific regions between channel pairs, but instead would tend to produce a positive detection signal for thermal neutrons striking anywhere across much (if not all) of that surface. Thus, the ability to perceive a shape of the emitting object through summing pixelated detection signals would be significantly impaired.

Accordingly, as will now be appreciated one would have been motivated ***<u>not</u>*** to provide

both pBN and dopant as a co-deposit, as in Honma, to form the pBN layers in the Leist reference because to do so would significantly impair and probably destroy a key feature of the described detector; point detection of thermal neutrons striking the edge surface of the layered structure. The very reason pBN layers in Leist are deposited first, *and then* dopant is provided into channels 20 via ion-implantation (col. 4 lns. 29-45), is that distribution of dopant across an entire c-plane of the pBN layers is to be avoided. Accordingly, in view of the foregoing it is respectfully submitted that the rejections of claim 1 have been overcome.

Claims 10 and 18 have been amended similarly as claim 1. Specifically, claim 10 is a method of forming a neutron detector that now recites "forming a layered structure having opposed surfaces and comprising at least *a plurality of layers* having an electrical resistivity of less than about 10^{14} ohm-cm and a thickness of between 1-1000 microns between the opposed surfaces, said plurality of layers comprising pyrolitic boron nitride (pBN) containing boron-10 (^{10}B) isotope and an elemental *dopant distributed across a c-plane in said plurality of layers*." Leist neither discloses nor fairly suggests such a method because, as explained above, one would not have been motivated (and in fact would have been motivated *not*) to form a neutron detector having dopant distributed across a c-plane in doped pBN layers.

Claim 18, which is a method for measuring thermal neutron emission, has been amended similarly as claim 10 to recite providing a detector that comprises a plurality of doped layers with the dopant being "distributed across a c-plane" in the doped layers.

Accordingly, it is respectfully submitted the rejections of claims 10 and 18 as now presented also have been overcome for the same reasons as discussed above for claim 1.

If the Examiner should have any questions or concerns with respect to the instant submission, she is invited and requested to please contact the undersigned attorney at the phone number listed below.

Respectfully Submitted,

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